3.0 Brightwater Outfall Siting Area

The following section provides known information regarding habitat distribution and usage of the various habitats in the Brightwater Outfall Siting Area by the species covered in this report (listed in Section 2.0). Readily known distribution and relative abundance for the covered species in the Brightwater Outfall Siting Area are also provided. Data gaps are identified in this section where appropriate; however, a detailed discussion regarding data gaps is provided in Section 6.0.

A comprehensive examination of the physical oceanographic characteristics of the Brightwater Outfall Siting Area is beyond the scope of this report. A general review of the entire study area has been conducted by Evans-Hamilton, Inc. and is available in a separate document (Ebbesmeyer and Cannon 2000). Therefore, information regarding physical oceanography is not provided in this report. Water and sediment chemistry data in the Brightwater Outfall Siting Area are also beyond the scope of this report. This information is available in King County Water Quality Status Reports for Marine Waters (King County 1999, 2000b), Washington Department of Ecology's SEDQUAL database, Washington Department of Ecology's Marine Water Quality Reports (Newton et al. 1997, 1998), as well as through reports that will be produced by the County's Marine Outfall Siting Study team.

3.1 Physical Setting

The Brightwater Outfall Siting Area (Area 1) extends from Mukilteo to Golden Gardens Park at Meadow Point (see Figure 1-1). There are diverse habitats within this area including sandy beaches, stream mouths, and rocky reefs. The supralittoral portion of the nearshore (>+3 m MLLW) supports the bed and tracks of the Northern Pacific Rail Road. There are several beaches in this area heavily used by the public, such as Golden Gardens, Carkeek Park, and Picnic Point. Marinas in this area include the Shilshole Bay Marina and Edmonds Marina, as well as the Edmonds ferry dock. The deepest water depth in the Brightwater Outfall Siting Area, and also the deepest depth in Puget Sound, is 285 m in the main channel off Point Jefferson. The shallow subtidal zone generally consists of sands, gravel, and cobble with outcroppings of rocks and some rocky reefs. The seafloor shelf in the Brightwater Outfall Siting Area is somewhat shallow with water depths of 20-30 m. At this point the shelf steepens substantially, dropping into the slope portion of the aphotic zone. A bathymetry map is presented to provide more information regarding the slopes and depths of the seafloor in the Brightwater Outfall Siting Area (see Figure 3-1).

3.2 Habitat Distribution

In this section, the general distributions of the major habitats are presented. Some information is also provided on the types of fauna associated with these habitats (e.g., eelgrass). The habitats are discussed under three subheadings: supralittoral, intertidal and shallow subtidal, and finally the deep subtidal. For more information on the types of fauna associated with these habitats, see Section 2.6.

3.2.1 Supralittoral

Vegetated habitats in the supralittoral zone have not been comprehensively surveyed. The shoreline in the Brightwater Outfall Siting Area typically consists of high and low bank bluffs, with a gravel and coarse sand beach below. The vegetation along undisturbed shorelines often consists of trees, such as fir and alder, and many vascular plants, grasses, and shrubs. Data from the Washington Department of Natural Resources (WDNR) 1999 Shorezone Database[3] (WDNR 1999) indicate that seawalls predominantly border the shoreline in the Brightwater Outfall Siting Area (see Figure 3-2). Overhanging vegetation occurs in some of the areas bordered by seawalls. Seawalls and shoreline armoring impact the benthic community during construction and changes in bottom substrate and vegetation result from the changes in wave and current patterns following construction (Williams and Thom in prep.). Seawalls can reduce the intertidal zone and soft bottom communities, increase rocky shore communities, and may impact fish migration, predation, and habitat.

3.2.2 Intertidal through Shallow Subtidal

The intertidal and shallow subtidal zones in the Brightwater Outfall Siting Area contain a wide variety of substrate types and vegetation. The distributions of some of the major vegetation taxa in the nearshore habitats are shown in Figures 3-3 through 3-7 and are discussed in more detail in the following paragraphs.

Although there are at least 157 species of benthic algae that have been reported (Thom et al. 1976), there are two taxa of seaweed *Fucus gardneri* (rock weed) and *Ulva* spp. (sea lettuce) that predominate on the beaches in the Brightwater Outfall Siting Area. *Fucus* is always found attached to more stable rocks ranging from small cobble through boulders (Thom 1983). *Fucus* is very common but generally patchy in the Brightwater Outfall Siting Area (Figure 3-3), indicating extensive high intertidal rocky substrate (Detheir 1990). This can include both natural substrate (e.g., cobbles and boulders) and artificially placed hard structures (e.g., rip rap and concrete). *Ulva* is found almost continuously along the shoreline of the Brightwater Outfall Siting Area (Figure 3-4). It occurs

[3] WDNR Shorezone Database is based on aerial surveys conducted by helicopter. The data on geological features and habitats were then translated into an ArcView Database. For purposes of this report, only general features of the supralittoral zone were extracted.

primarily in patches but is found in continuous beds near Edmonds and Shilshole Bay. *Ulva* typically attaches to pebbles or larger-sized substrata but may also be found in viable free-floating patches deposited along beaches. It is within these exposed and semi-exposed rocky habitats that a wide variety of species are found, including recreational and commercially important bivalves (Armstrong et al. 1976, Dethier 1990). Fish species that use prey produced in these habitats include coho salmon, cutthroat trout, Dolly Varden, and river lamprey (Simenstad et al. 1991)

Laminaria spp. is rare throughout most of the region (Figure 3-5). It is found mostly in patches in both the low intertidal and shallow subtidal zones of the southern region (Thom et al. 1976). Kelp is also rare in the region according to the WDNR Shore zone Database (WDNR 1999) and surveys conducted in 1999 by Battelle Marine Sciences Laboratory for King County (Woodruff et al. 2000), with the densest patches near Edmonds and Shilshole marina (Figures 3-6 and 3-7). Because it needs to attach to stable rocks, the distribution of kelp coincides with the more typical rocky substrates found in the deeper intertidal and shallow subtidal habitats.

Intertidal eelgrass (predominately *Zostera marina*) is very common in the Brightwater Outfall Siting Area, but is generally patchy (Figures 3-6 and 3-7). Eelgrass is moderate to dense and more or less continuously distributed in the shallow subtidal zone between Picnic Point and Shilshole Bay. Eelgrass commonly occurs in shallow soft bottom tide flats, along channels and in the shallow subtidal fringe. These eelgrass communities serve as habitat for many different species and provide feeding and refuge habitats for chum salmon, lingcod, herring, sand lance, and surf smelt (Dethier 1990; Simenstad et. al 1991). Although this report focuses on these and other species of concern (see Section 2), eelgrass habitat hosts many other species of importance such as perch, crab (Dethier 1990), and various other invertebrates (Simenstad, et. al 1991) that serve as prey resources for salmonids (See Appendix A). Eelgrass distributions depicted in Figures 3-6 and 3-7 indicate that a transition occurs from the predominant coarser rocky substrates in the lower intertidal and upper subtidal substrates to finer grained sediment types (e.g., sand, mixed fines, silt, and mud) that support eelgrass in the lower shallow subtidal habitats (Dethier 1990).

Tideflats, consisting of unconsolidated sands, silts, and clays, occur throughout the Brightwater Outfall Siting Area, but have not been mapped completely. They are widest in the middle portion of embayments such as near Richmond Beach, Carkeek Park and West Point (Armstrong et al. 1976). Infaunal communities in the Brightwater Outfall Siting Area contain a number of amphipod and other crustaceans, as well as many species of bivalves, such as *Macoma* spp., (Armstrong et al. 1976). The crustacea are prey for juvenile salmonids (See Appendix A). Tideflats are proven to contain productive microalgae as well as prey resources (e.g., harpacticoids, copepods, and amphipods) for juvenile chinook and chum salmon (Simenstad et al 1991).

3.2.3 Deep Subtidal

Very little habitat data have been generated for the deep subtidal portion of the Brightwater Outfall Siting Area. Surface sediment maps compiled by Roberts (1979) indicate that sediment in the upper edge of the deep subtidal consists of sand with some silt. The depths presented here, based on Robert's data, are approximate because depth data were not presented on his maps. Sediment samples collected in about 40 m of water off of the Richmond Beach Outfall contained large amounts of rounded cobble mixed with coarse sand. The dominant organisms at all five stations were the tube-building polychaete *Phyllochaetopterus prolifica* and the ostracod *Euphilomedes carcharodonta* (Word et al. 1981). Sediment samples collected by the Puget Sound Ambient Monitoring Program (PSAMP) off of Mukilteo, South Picnic Point, and Richmond Beach were consistent with the Roberts data in that sand was the primary sediment type (Tetra Tech 1990; Striplin et al. 1990, 1991, 1993). The dominant infaunal invertebrates at these locations were similar to the 1981 survey with the addition of the bivalve mollusc *Psephedia lordi* at the Mukilteo and South Picnic Point locations.

There is very little information available documenting habitat characteristics in the intermediate water depths in the Brightwater Outfall Siting Area.

Robert's maps indicate that from just north of Edmonds through Richmond Beach the sediment grades from sand to a mix of sand and silt with increasing water depth. The maps do not extend to the central portion of the deep Puget Sound Basin. PSAMP sampled one station at the base of the slope in 182 m of water off of Norma Beach and the sediment consisted of an even mix of silt and clay and was dominated by the polychaetes *Pectinaria californiensis*, the bivalve molluscs *Macoma carlottensis* and *Axinopsida serricata* and the crustaceans *Euphilomedes producta* and *Eudorella pacifica* (Tetra Tech 1990). A second PSAMP station located in 260 m of water along the west side of the central basin (where Admiralty Inlet enters the central basin) contained sand with large amounts of molluscan shell debris. These shells were 3-4 cm in length and were *Macoma calcarea*, a species typically found in shallow water. Their presence at this location is indicative of the strong bottom water currents in this portion of the central basin. This station, located in the deepest part of the central basin, was dominated by bivalve mollusc *Macoma carlottensis* and the ostracod *Euphilomedes producta*.

3.3 Species Distribution and Occurrence

The distribution and occurrence information presented below for the HCP covered species is based upon documented information cited in available literature and/or personal communication with biologists/experts from local, state, and federal agencies. Much of the distribution data for fishes are based upon trawl and video data and are dependent upon the time of year, depth, and

location sampled. Many pelagic fish, such as yellowtail and black rockfish, are rarely documented in trawl surveys as the sampling method favors capturing semi-demersal or demersal fish such as lingcod, Pacific cod, and quillback rockfish. The absence of pelagic and other species from trawl and video data does not preclude those species from inhabiting waters in the Brightwater Outfall Siting Area, and is instead a reflection of the sampling method. Most of the data for marine birds are based upon seasonal aerial surveys and seasonal land surveys and are dependent upon favorable sighting conditions, time of year surveyed, species wariness, and location surveyed.

3.3.1 Marine Mammals and Birds

Orca – *Orcinus orca*

The southern resident Orca whale community, particularly the J pod, is known to occasionally enter inland Puget Sound waters in search of prey. For the past several years, Orcas have been seen in central Puget Sound in the fall, particularly in September and October (K. Koski, Whale Museum, pers. comm.). They have been seen in central Puget Sound from June through October, but as stated above, the most frequent occurrences are in the fall as the whales follow the salmon runs (Balcomb and Goebal 1976; Balcomb 1982; Olesiuk et al. 1990). Thus, the whales travel through the waters of the Brightwater Outfall Siting Area as they travel south following their prey.

The J, K, and L pods currently consist of 19, 17, and 47 whales, respectively (A. Traxler, Whale Museum, pers. comm.). Transient whales have not been documented in the Brightwater Outfall Siting Area and are not known to occur in inland Puget Sound waters.

Harbor Porpoise – *Phocoena phocoena*

The inland Washington stock of harbor porpoises are seen along the Straits and outer coasts with no confirmed sightings south of Admiralty Inlet for the last several years, and sightings south of the Straits extremely rare (Calambokidis et al. 1992; B. Hanson, NMML, pers. comm.). During a yearlong survey in 1996, no harbor porpoises were seen in Puget Sound even though sighting conditions were favorable (Osmek et al. 1997). In 1994, there were two harbor porpoise strandings in south Puget Sound and it is likely that poor health caused these two porpoises to enter the sound (Osmek et al. 1997). There have been no documented harbor porpoise sightings in the Brightwater Outfall Siting Area. NOAA's National Marine Mammal Laboratory began cyclical surveys in 1991, and distribution and abundance of both harbor and Dall's porpoises were surveyed in 1996 and are scheduled to be surveyed again in 2001. The minimum population estimate of the inland Washington harbor porpoise stock in the draft 2000 marine mammal stock assessment report is 2,545 porpoises (Forney et al. 2000).

Steller Sea Lion – *Eumetopias jubatus*

Most Steller (or northern) sea lions in Washington State occur along the coast from Cape Flattery to the mouth of the Columbia River. Steller sea lions are also found in the San Juan Islands and Strait of Juan de Fuca. Some Steller sea lions do occur in the inland waters of Puget Sound, but in small numbers. They are migratory and may be seen at any time of the year, but appear to be the most abundant during summer and fall (Gearin at al. 1988; Chumbley 1993). There are no Steller sea lion rookeries in the Brightwater Outfall Siting Area.

As Steller sea lions are migratory, they may occur in the Brightwater Outfall Siting Area as they travel south from the San Juan Islands and the Strait of Juan de Fuca. They also use navigational buoys and jetties as haul out sites (Jeffries et al. 2000). In September 2000, King County staff observed a large male Steller sea lion hauled out on the jetty of the Shilshole Bay Marina in the southern portion of the Brightwater Outfall Siting Area.

Common Murre – *Uria aalge*

Common murres are permanent residents of the Washington Coast and are seen most frequently in the San Juan Islands, Strait of Juan de Fuca and in smaller numbers in Puget Sound (Angell and Balcomb 1982). The Washington State Department of Fish and Wildlife's (WDFW's) PSAMP bird component uses aerial surveys to evaluate bird populations. WDFW's surveys found that from 1992 through 1999 the number of common murres found in the Brightwater Outfall Siting Area in the winter ranged from 0 to 25 animals per square kilometer (animals/km^2) (Figure 3-8) (WDFW 2000). In the summer months, the average number of common murres ranged from 0 to 257 animals/km^2 (Figure 3-9). Because of the small size and wariness of the bird species counted in this survey, the absence of sightings does not preclude the presence of these birds in the survey area in greater numbers than those observed (WDFW 2000).

Common murres have been noted in the southern portion of the Brightwater Outfall Siting Area for the Seattle Christmas Bird Count (CBC) annual survey every year since 1983. The survey area is limited to a 15-mile diameter circle centered near downtown Seattle conducted in a 24-hour period (H. Opperman, Seattle Audubon Society, pers. comm.). Numbers for murres in the CBC survey varied from year to year with 7 birds being the lowest and 225 birds being the highest (H. Opperman, Seattle Audubon Society, pers. comm.).

Marbled Murrelet – *Brachyramphus marmoratus*

This species is a fairly common winter visitor in the Strait of Juan de Fuca and the San Juan Islands but a less common visitor to Puget Sound. They are most commonly seen in the San Juan Islands and adult birds may be seen throughout the year with the largest concentrations in the fall and winter (Angell and Balcomb 1982). WDFW (2000) found that from 1992 through 1999 the winter observations of marbled murrelets in the Brightwater Outfall Siting Area revealed no birds within this area (Figure 3-10). In the summer months, from 1 to 4 birds

were observed in the area south of Everett (Figure 3-11). Marbled murrelets are small, wary, diving birds and the lack of sightings and the low numbers observed in the WDFW surveys may not accurately reflect the distribution and abundance of this species within the study areas. Marbled murrelets have only been seen in the southern portion of the Brightwater Outfall Siting Area in 8 out of 17 years since the start of the Seattle CBC annual survey in 1983. The number of birds has ranged from 1 to 17, but usually only 1 to 3 birds have been seen in years when this species was present (H. Opperman, Seattle Audubon Society, pers. comm.).

Harlequin Duck – *Histrionicus histrionicus*

Harlequin ducks are permanent Washington residents that breed inland along rivers and streams in the Cascades, including eastern King and Snohomish Counties. Males gather in small flocks in Puget Sound in late summer and then the females bring their young from the rivers and streams to winter with the males from October to May (Angell and Balcomb 1982). The largest concentrations are seen near Protection Island and Marrowstone Island where molting birds gather to feed and rest in June and July (Angell and Balcomb 1982). The Dungeness National Wildlife Refuge is an important wintering habitat for harlequin ducks and as such they are a regular winter visitor in the central Puget Sound Basin. WDFW (2000) found that from 1992 through 1999 the number of harlequin ducks in the Brightwater Outfall Siting Area in the winter ranged from 0 to 10 animals per square kilometer (see Figure 3-12). In the summer months, no harlequin ducks were counted in this area (see Figure 3-13). As noted previously, the lack of sightings in the WDFW surveys could be due to the small size and wary nature of these birds (Angell and Balcomb 1982). Harlequin ducks have been noted in the southern portion of the Brightwater Outfall Siting Area for the Seattle CBC survey every year since 1983, with 18 being the lowest number counted and 59 birds being the highest (H. Opperman, Seattle Audubon Society, pers. comm.).

3.3.2 Salmonids

Bull Trout – *Salvelinus confluentus*

Little is known of the distribution and abundance of bull trout in Puget Sound estuaries and nearshore waters. There are no documented reports of bull trout in the Brightwater Outfall Siting Area. However, anadromous bull trout have been documented or are thought to occur in the Skagit River, Skykomish River, Green River, and possibly the Lake Washington watersheds; therefore, it is likely that bull trout use the subtidal and nearshore waters in the Brightwater Outfall Siting Area as a migratory pathway (WDFW 1998). Spring to mid-late summer is the most likely time that bull trout would be found in the Brightwater Outfall Siting Area as spring is when both juveniles and adults enter estuarine areas and remain until mid-late summer before returning to freshwater (WDFW 1998; Kraemer 1994).

Chinook, Chum, Coho, Sockeye, Salmon and Cutthroat Trout – *Oncorhynchus* spp. — Juvenile

There is limited information regarding juvenile salmonid distribution in the Brightwater Outfall Siting Area. However, it is likely these species use the nearshore and offshore waters as a migratory pathway (and as rearing habitat for some species, including chinook), as these salmonids have documented populations in rivers and streams surrounding the Brightwater Outfall Siting Area.

Beach seining surveys were conducted from June to August 2000 by King County (Mavros and Brennan, in prep.) at two beaches in the Brightwater Outfall Siting Area: Picnic Point and Richmond Beach. These surveys documented wild and hatchery juvenile chinook salmon in the nearshore area at Picnic Point in July and August and also at Richmond Beach from June to August. Juvenile steelhead trout were also found at Picnic Point in July and August and at Richmond Beach in August. No other salmonids were found at Picnic Point but two juvenile coho were seen at Richmond Beach in June.

Chinook, Chum, Coho, Sockeye, Salmon and Cutthroat Trout – *Oncorhynchus* spp. — adult

A compilation of distribution data for Puget Sound fishes through 1973 by Miller and Borton (1980) shows observations of chinook and chum salmon within most sections of the Brightwater Outfall Siting Area. There were also observations of coho and sockeye salmon in nearshore and offshore waters in the Brightwater Outfall Siting Area prior to 1973. Miller and Borton reported cutthroat trout were present throughout the nearshore waters of the Brightwater Outfall Siting Area. Although abundance data were not presented for the Miller and Borton report, the widespread occurrence of cutthroat trout indicates a degree of abundance for this species in this area (see Figures B-6 through B-10 in Appendix B).

The 1992 Washington State Salmon and Steelhead Stock Inventory (SASSI) conducted by WDFW (1993) did not document populations of chinook, chum, coho, and sockeye salmon in streams or rivers within the Brightwater Outfall Siting Area. However, rivers and streams surrounding the study area revealed populations of both chinook and chum, some of which were listed as healthy with consistent returns (WDFW 1993b). It is likely that the migratory pathway of all these salmonids includes the waters in the Brightwater Outfall Siting Area.

Steelhead – Oncorhynchus mykiss

Several isolated observations of steelhead in the Brightwater Outfall Siting Area prior to 1973 were documented as shown in Figure B-11, Appendix B (Miller and Borton 1980). These observations were nearshore with a cluster near the entry to the Lake Washington waterways. Although not in the Brightwater Outfall Siting Area, major rivers in Puget Sound, such as the Skagit, Skykomish, and Green Rivers, support populations of winter and summer-run steelhead and it is likely

that their migratory pathways include waters in the Brightwater Outfall Siting Area (Pauley et al. 1986).

3.3.3 Lamprey

There is very little distribution and abundance information for the two species of lamprey addressed in this report.

Pacific Lamprey (*Entosphenus tridentatus*) and River Lamprey (*Lampetra ayresi*)

At this time there are no site-specific data for Pacific and River lampreys in the Brightwater Outfall Siting Area. However, these lampreys are known to exist in Washington waters and therefore may be present in the Brightwater Outfall Siting Area streams and marine waters (Hart 1980; Wydoski and Whitney 1979).

3.3.4 Invertebrates

Northern Abalone – *Haliotis kamtschatkana*

No known site-specific information was readily available for Puget Sound. The northern abalone is generally not found in estuaries and there were no documented occurrences in the Brightwater Outfall Siting Area. This species is primarily found on the outer coast and in the Straits and the farthest south the northern abalone has been seen is by the Keystone ferry dock on the western side of Whidbey Island (R. Anderson, Seattle Aquarium, pers. comm.).

Olympia Oyster – *Ostrea conchaphila*

Site-specific information of the Olympia oyster in the Brightwater Outfall Siting Area is not known and there were no documented occurrences. However, Olympia oysters do occur in inland Puget Sound waters but are abundant only in southern Puget Sound (Cook et al. 1998). They most likely do settle out in other areas in Puget Sound in relatively low abundance; however, it is not enough to sustain a breeding population. This is because Olympia oysters spawn in water temperatures from 13 to 16 °C (Couch and Hassler 1989) and the waters in the Brightwater Outfall Siting Area are colder than spawning requirements (King County 2000b), thus preventing an abundance of this species in the area.

3.3.5 Marine Fish

Of the 24 species of marine fishes addressed in this report, nine were observed and identified in the Brightwater Outfall Siting Area. These observations are based on data from WDFW's Technical Report No. 79 (WDFW 1992) (Figure 3-14), WDFW's video and trawl surveys (Figure 3-15) and video surveys conducted by Battelle Marine Sciences Laboratory for King County (Woodruff et al. 2000) (Figure 3-16). These data sources also noted at least two additional

species, however, they were not positively identified. These unidentified species were grouped as baitfish (herring or sand lance) and rockfish (*Sebastes* spp.).

The marine fish species are listed in Table 3-1 along with their distribution, the primary habitat on which they were most often observed, the depth range at which they were observed, and their relative abundance within the Brightwater Outfall Siting Area. The fact that a species was not observed does not mean that it was not present. These species are mobile and many tend to hide in cracks and crevices. In addition, many of these species have cryptic coloration making them difficult or impossible to see even when they are in the open. Seasonal variation in food resources, life history stages (e.g., spawning, juvenile recruitment), or environmental conditions can also affect the presence, distribution, and abundance of these fish species. Much of the fish information was derived from video and trawl surveys, which are limited to few sampling locations and low sampling frequency. In addition, many species that occur primarily in open and mid-water habitats or are active at night will be underestimated due to survey method.

Ground Fish

Green (*Acipenser medirostris*) and White (*Acipenser transmontanus*) Sturgeon

No specific records of green or white sturgeon in the Brightwater Outfall Siting Area were found, but Miller and Borton (1980) did report two records of green/white sturgeon occurrences somewhere within Puget Sound (see Figures B-3 and B-4, Appendix B). Because the specific locations were unknown, it is possible that they were in the Brightwater Outfall Siting Area.

Pacific Cod – *Gadus macrocephalus*

Occurrences of Pacific cod in the Brightwater Outfall Siting Area were reported by Miller and Borton (1980) (see Figure B-15, Appendix B) and also by WDFW (Figure 3-15 and Appendix C). Pacific cod were observed from Edmonds south, with most observations near Meadow Point.

Palsson et al. (1997) designated the Pacific cod stock status for Puget Sound as "critical." They suggested the Pacific cod fishery was over-utilized and estimated the 1991 population abundance at 47,000 individuals (down from 1.6 million estimated in 1987).

Walleye Pollock – *Theragra chalcogramma*

In addition to information from the WDFW surveys (see Figure 3-15 and Appendix C), Miller and Borton (1980) reported observations of walleye pollock throughout the Brightwater Outfall Siting Area, especially in the southern end (see Figure B-17, Appendix B). Quinnell and Schmitt (1991) found walleye pollock most abundant at depths between 38 and 73 m.

Palsson et al. (1997) designated the walleye pollock stock status for Puget Sound as "critical." They suggested the walleye pollock fishery was over-utilized and

estimated the 1991 population abundance at 99,000 individuals (down from 3.5 million estimated in 1987).

Pacific Hake – *Merluccius productus*

In addition to distribution data from the WDFW survey (Figure 3-15 and Appendix C), Miller and Borton (1980) reported observations of Pacific hake throughout the Brightwater Outfall Siting Area, especially in the southern end (see Figure B-16, Appendix B). Quinnell and Schmitt (1991) found Pacific hake most abundant at depths between 75 and 110 m.

Most of the south-central Puget Sound Pacific hake spawn to the north of the Brightwater Outfall Siting Area in Port Susan (Palsson et al. 1997). It is probable that Pacific hake of all ages pass through the Brightwater Outfall Siting Area on their way to or from the spawning area, especially during spawning season (spring).

Lingcod – *Ophiodon elongates*

In addition to the observations during the Battelle video survey (Woodruff et al. 2000) and WDFW video and trawl surveys (Figure 3-15 and Appendix C), Miller and Borton (1980) reported observations of lingcod near Edwards Point and Meadow Point (see Figure B-33, Appendix B). Quinnell and Schmitt (1991) found lingcod most abundant at depths between 9 and 37 m or greater than 110 m.

Palsson et al. (1997) designated the lingcod stock status for Puget Sound as "above average." They suggested the lingcod fishery was fully utilized and estimated the 1991 population abundance at 7,000 individuals (equal to the estimation in 1987).

Forage Fish

Pacific Herring – *Clupea harengus pallasi*

In addition to data from WDFW trawl surveys (Figure 3-15 and Appendix C), Miller and Borton (1980) reported observations of Pacific herring throughout the Brightwater Outfall Siting Area, especially in the southern end (see Figure B-5, Appendix B). Herring were not distinguished from sand lance during the Battelle video surveys (Woodruff et al. 2000), and were reported as either herring or sand lance (Figure 3-16). Quinnell and Schmitt (1991) found Pacific herring most abundant in shallow water (9-37 m) and estimated an abundance of nearly 1.5 million individuals in the central Puget Sound area in 1987.

While there are no documented Pacific herring spawning grounds within the Brightwater Outfall Siting Area (Figure 3-14), spawning grounds are documented to the south (Quartermaster Harbor), west (Port Orchard/Madison), and north (Port Susan) (Lemberg et al. 1997). It is probable that Pacific herring of all ages pass through the Brightwater Outfall Siting Area on their way to or from the

spawning grounds, especially during spawning season (late January through early June).

Sand Lance – *Ammodytes hexapterus*

Miller and Borton (1980) reported observations of sand lance near Edwards Point, Point Wells and in the southern end of the Brightwater Outfall Siting Area near Meadow Point, where most observations have been documented (see Figure B-18, Appendix B). There are also documented spawning grounds near Edwards Point and Meadow Point (see Figure 3-14). Currently King County and WDFW are further evaluating the presence of spawning grounds in the Brightwater Outfall Siting Area.

Beach seining surveys were conducted from June to August 2000 by King County (Mavros and Brennan, in prep) at two beaches in the Brightwater Outfall Siting Area: Picnic Point and Richmond Beach. These surveys documented sand lance in the nearshore areas at Richmond Beach and Picnic Point during all three months. The highest number of sand lance observed per set ranged from 500 fish in June at Richmond Beach to 300 in July at Picnic Point.

Surf Smelt – *Hypomesus pretiosus*

Miller and Borton (1980) reported observations of surf smelt near Edwards Point and in the southern end of the Brightwater Outfall Siting Area near Meadow Point, where most observations have been documented (see Figure B-13, Appendix B). There are also documented spawning grounds near Edwards Point and Meadow Point (Figure 3-14). Currently King County and WDFW are further evaluating the presence of spawning grounds in the Brightwater Outfall Siting Area.

The beach seining surveys conducted from June to August 2000 by King County (Mavros and Brennan, in press) at two beaches in the Brightwater Outfall Siting Area (Picnic Point and Richmond Beach) documented surf smelt in the nearshore areas at both beaches. Surf smelt were only seen at Picnic Point in July (the highest number of fish per set was 10) but were seen during all three months at Richmond Beach with the highest number per set being 100.

Eulachon – *Thaleichthys pacificus*

The only observations of Eulachon in the Brightwater Outfall Siting Area are the few records reported by Miller and Borton (1980). Their three observations were in the southern end of the Brightwater Outfall Siting Area near Meadow Point (see Figure B-14, Appendix B).

Rockfish

The following rockfish species covered in the HCP are distributed along the outer Washington coasts and in the Straits surrounding the San Juan Islands — but are not known to occur in inland Puget Sound waters or in the Brightwater Outfall Siting Area: blue, widow, china, and tiger rockfish (W. Palsson, WDFW, pers.

comm.; J. Christiansen, Seattle Aquarium, pers. comm.). The other rockfish species covered in the HCP are discussed below.

Brown Rockfish – *Sebastes auriculatus*

Miller and Borton (1980) reported observations of brown rockfish in the southern end of the Brightwater Outfall Siting Area near Meadow Point (see Figure B-19, Appendix B). Quinnell and Schmitt (1991) found brown rockfish most abundant at depths between 9 and 37 m and estimated an abundance of about 22,000 individuals in the central Puget Sound area in 1987.

Copper Rockfish – *Sebastes caurinus*

The WDFW surveys (Figure 3-15 and Appendix C) and Miller and Borton (1980) (see Figure B-20, Appendix B), reported observations of copper rockfish in the Brightwater Outfall Siting Area with most observations occurring in shallow waters near Edwards Point, Point Wells, and Meadow Point. Quinnell and Schmitt (1991) found copper rockfish most abundant at depths between 9 and 37 m and estimated an abundance of about 88,000 individuals in the central Puget Sound area in 1987.

Greenstriped Rockfish – *Sebastes elongates*

Greenstriped rockfish have been observed near Edmonds and in the southern end of the Brightwater Outfall Siting Area near Meadow Point (Miller and Borton 1980; see Figure B-21, Appendix B). WDFW did not observe this species at any of their video or trawl sampling locations in the Brightwater Outfall Siting Area. Adults of this species prefer deep waters (generally > 91 m) and the distribution of juveniles is not known (Hart 1980).

Yellowtail Rockfish – *Sebastes flavidus*

Miller and Borton (1980) reported observations of yellowtail rockfish in the southern end of the Brightwater Outfall Siting Area near Meadow Point (see Figure B-23, Appendix B). In addition, schools of adult yellowtail rockfish are commonly seen throughout the Brightwater Outfall Siting Area year-round in the water column at depths usually less than 46 m (Eschmeyer et al. 1983; J. Christiansen, Seattle Aquarium, pers. comm.). Juveniles are not seen in the Brightwater Outfall Siting Area but are found in the Straits in July and August (J. Christiansen, Seattle Aquarium, pers. comm.).

Quillback Rockfish – *Sebastes maliger*

In addition to the data from Battelle and WDFW surveys (see Figures B-15 and B-16, Appendix B), Miller and Borton (1980) reported observations of quillback rockfish near Edwards Point and in the southern end of the Brightwater Outfall Siting Area near Meadow Point (see Figure B-24, Appendix B). The WDFW trawl and video surveys found quillback rockfish throughout the Brightwater Outfall Siting Area, most often in rocky nearshore areas (Figure 3-15 and Appendix C). Quinnell and Schmitt (1991) found quillback rockfish most

abundant at depths between 38 and 73 m and estimated an abundance of about 740,000 individuals in the central Puget Sound area in 1987.

Black Rockfish – *Sebastes melanops*

Miller and Borton (1980) reported observations of black rockfish in the Brightwater Outfall Siting Area near Edwards Point, Point Wells, and Meadow Point (see Figure B-25, Appendix B). WDFW trawl surveys did not find black rockfish in the Brightwater Outfall Siting Area; however, it is not likely that this species would be found in trawl surveys, as this is a mid-water species. WDFW video surveys also did not find this species in the Brightwater Outfall Siting Area, however, this species was seen nearby in shallow water (< 12 m) at the southeastern end of Whidbey Island in rocky substrate (Figure 3-15 and Appendix C).

Bocaccio – *Sebastes paucispinus*

Miller and Borton (1980) reported an observation of bocaccio in the southern end of the Brightwater Outfall Siting Area near Meadow Point (see Figure B-29, Appendix B). This species was not found in the WDFW video and trawl surveys, possibly as a function of habitat use. This is primarily a deep, open water species (Hart 1980).

Canary Rockfish – *Sebastes pinniger*

Miller and Borton (1980) reported canary rockfish near Shilshole Bay in the southern portion of the Brightwater Outfall Siting Area (see Figure B-30, Appendix B). However, this species was not found in the WDFW video and trawl surveys and is rarely seen south of Hood Canal. This species is primarily found along the outer coasts and in the Straits (J. Christiansen, Seattle Aquarium, pers. comm.). In addition, surveying is difficult because this is mainly a deep, open water species(Hart 1980).

Redstripe Rockfish – *Sebastes proriger*

Miller and Borton (1980) reported observations of redstripe rockfish in the southern end of the Brightwater Outfall Siting Area near Meadow Point (see Figure B-31, Appendix B). WDFW did not observe redstripe rockfish in the Brightwater Outfall Siting Area during their video or trawl surveys. However, there was an observation for this species in the northeastern portion of the Kitsap Peninsula (Figure 3-15 and Appendix C) and it is possible that this species could occur in the Brightwater Outfall Siting Area. Quinnell and Schmitt (1991) found redstripe rockfish most abundant at depths between 75 and 110 m and estimated an abundance of about 5,000 individuals in the central Puget Sound area in 1987.

Yelloweye Rockfish – *Sebastes ruberrimus*

Miller and Borton (1980) reported observations of yelloweye rockfish in the southern end of the Brightwater Outfall Siting Area near Meadow Point (see Figure B-32, Appendix B). This solitary species is occasionally seen in the

Brightwater Outfall Siting Area in rocky crevices in deep waters (>18 m) (J. Christiansen, Seattle Aquarium, pers. comm.).

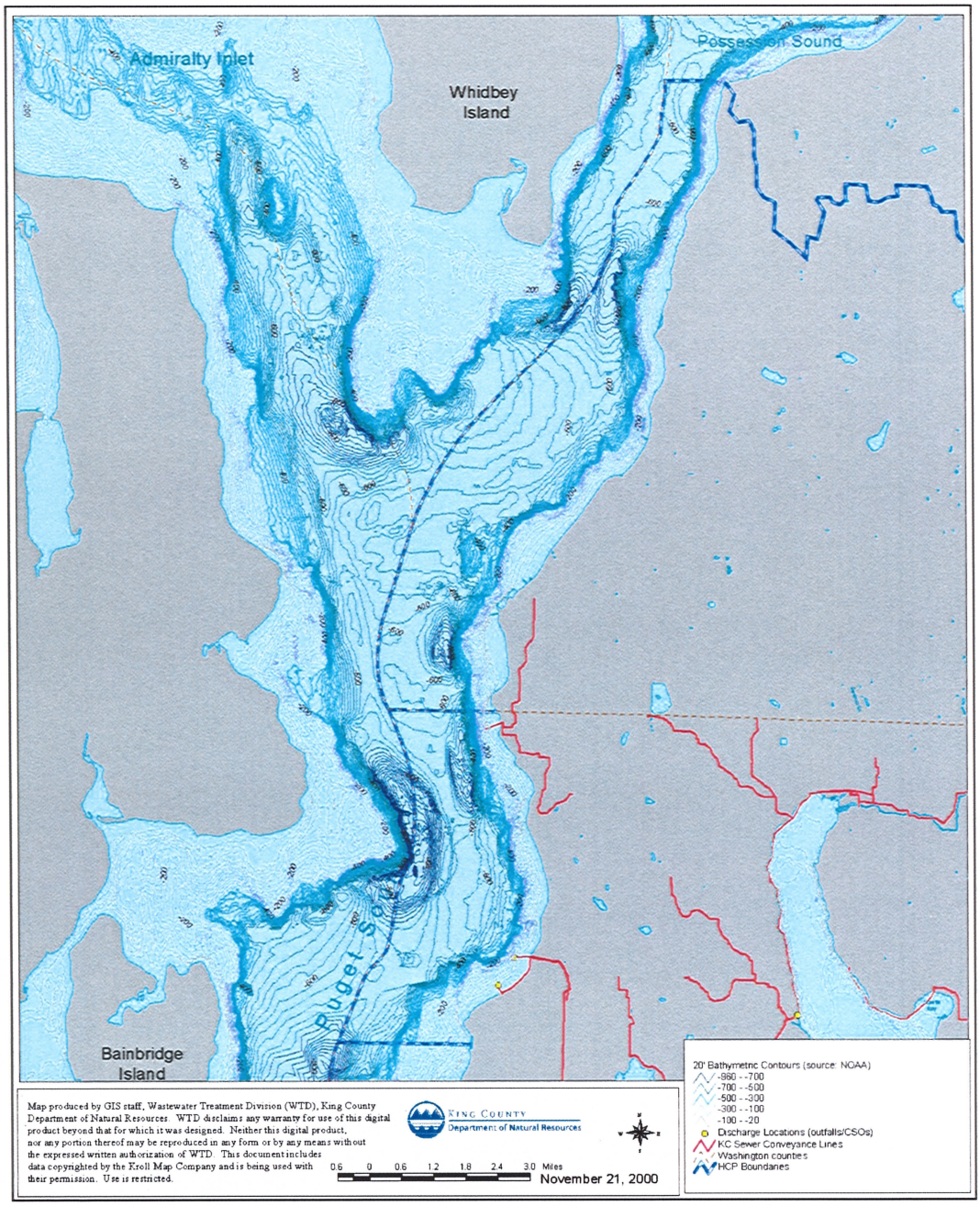

Figure 3-1. Bathymetric contours in the Brightwater Outfall Siting Area

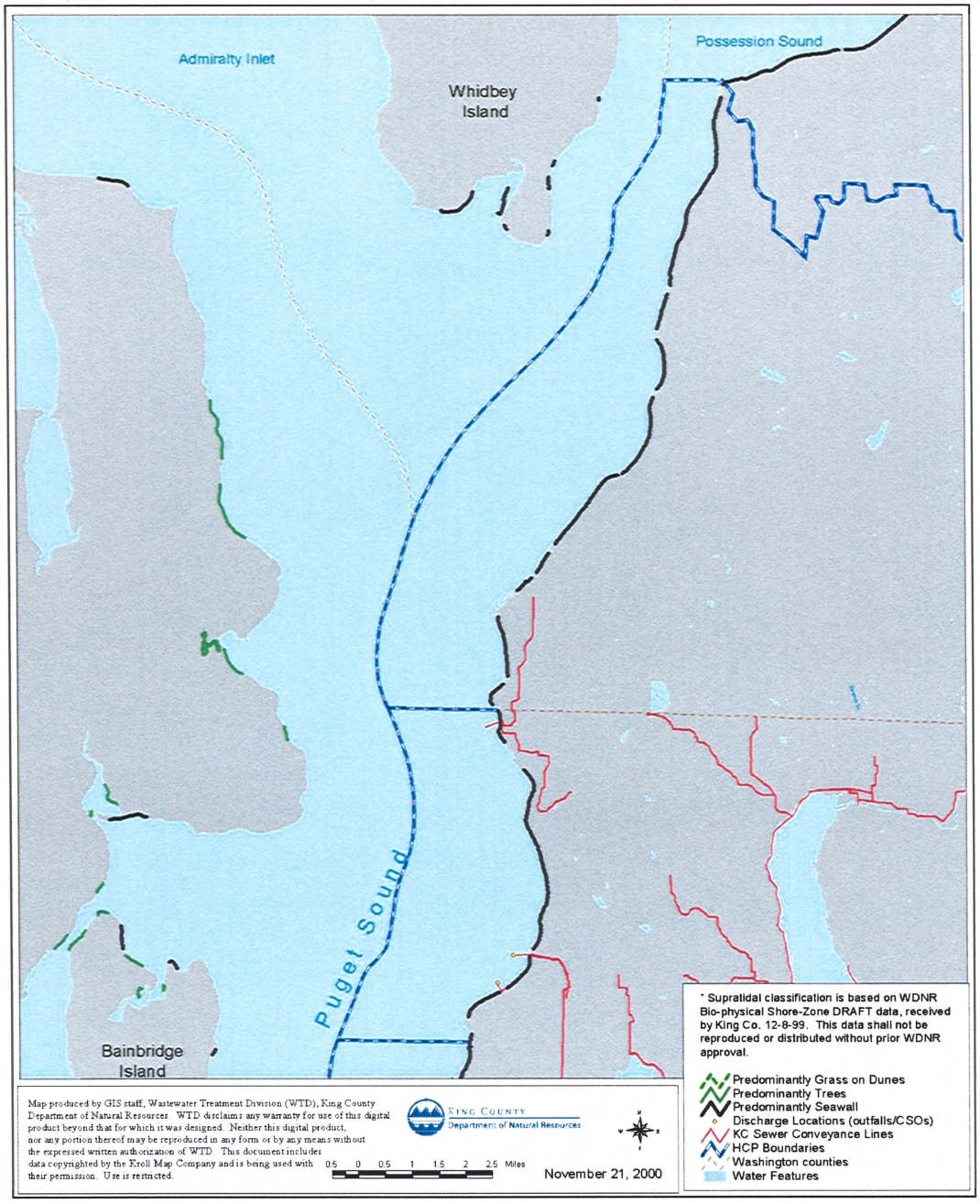

Figure 3-2. Supralittoral zone in the Brightwater Outfall Siting Area

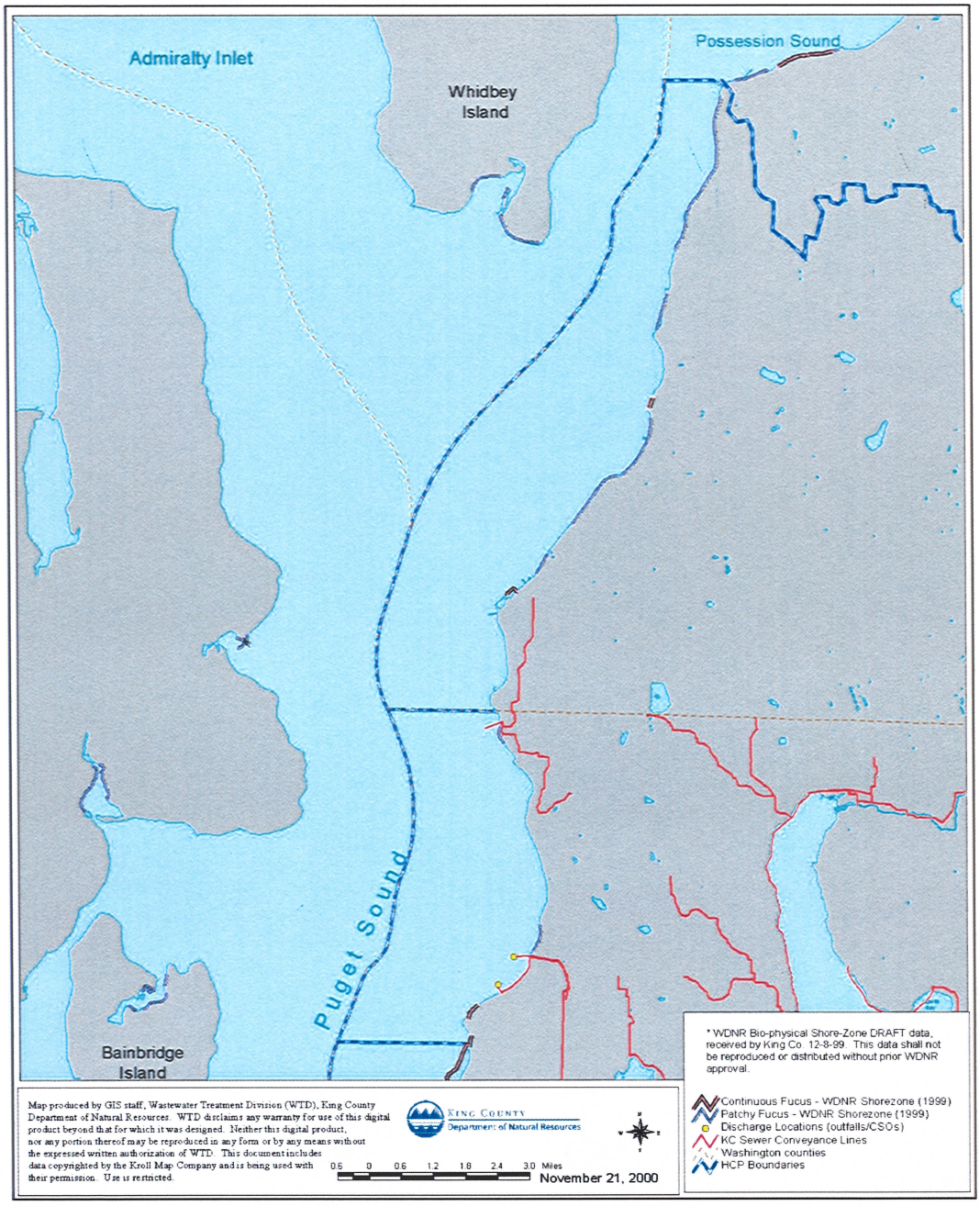

Figure 3-3. Distributions of rockweed (*Fucus*) in the intertidal zone of the Brightwater Outfall Siting Area

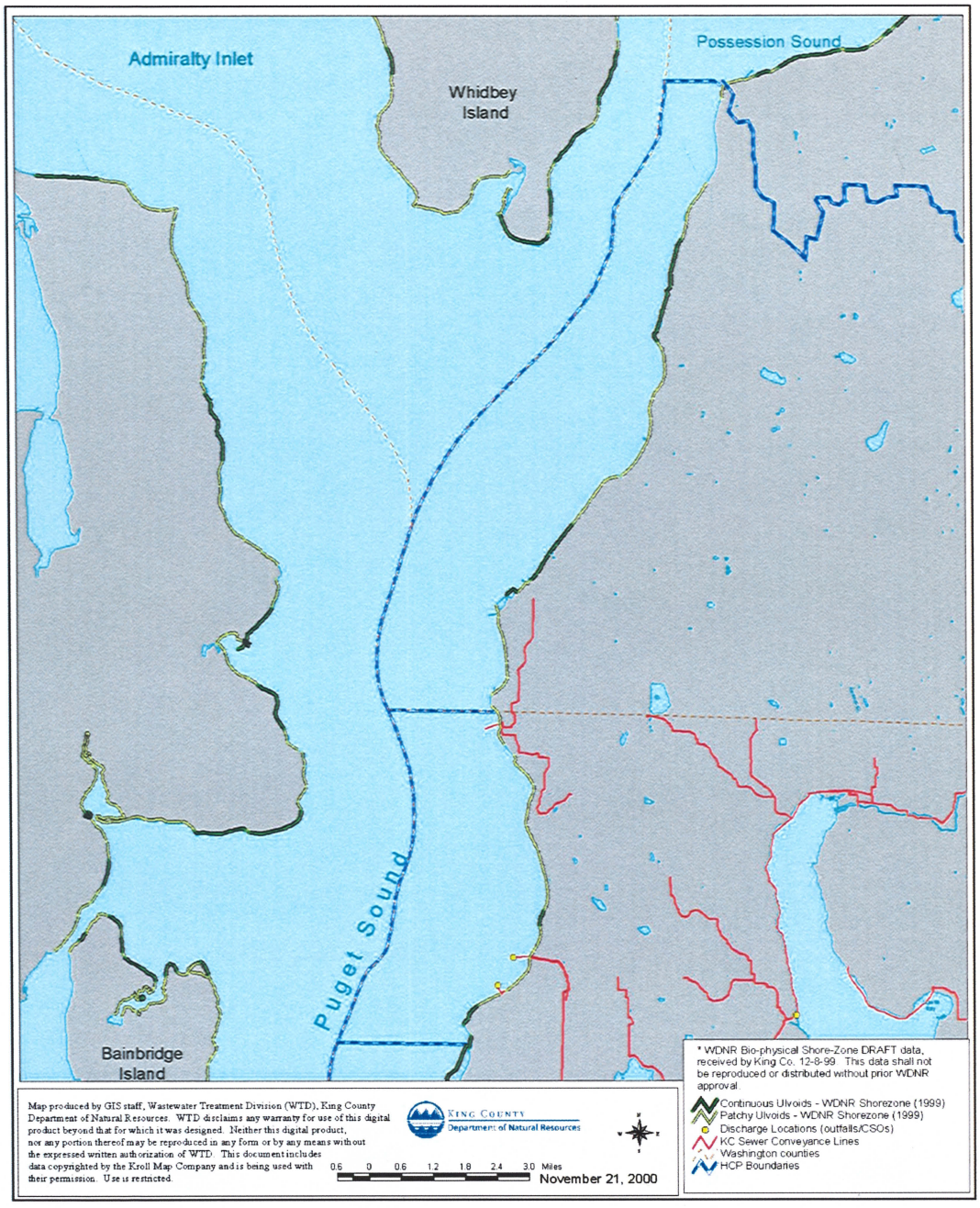

Figure 3-4. Distributions of Ulvoids in the intertidal zone through the shallow subtidal zone of the Brightwater Outfall Siting Area

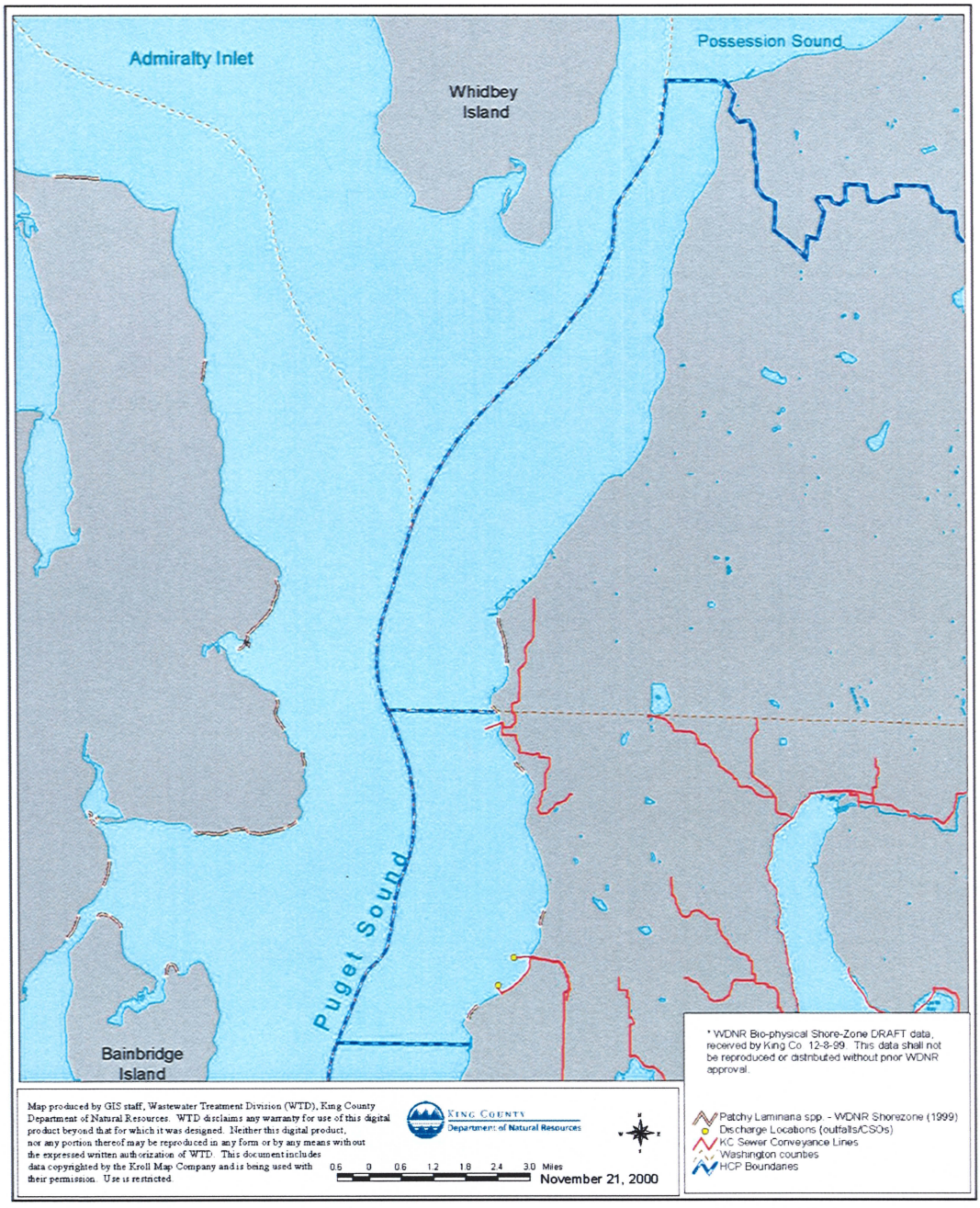

Figure 3-5. Distributions of *Laminaria* spp. in the intertidal zone through the shallow subtidal zone of the Brightwater Outfall Siting Area

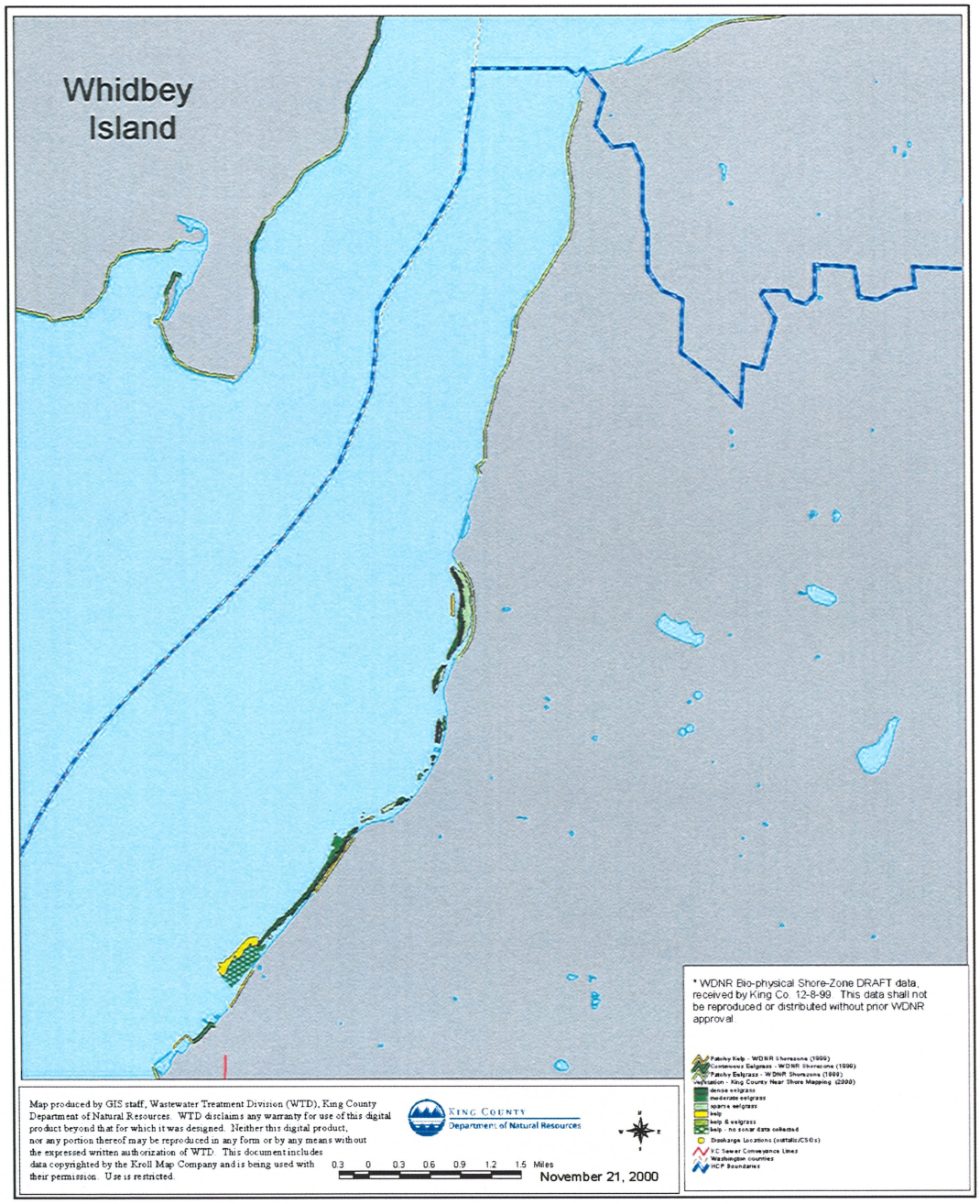

Figure 3-6. Distributions of eelgrass (*Zostera marina*) and kelp (*Nereocystis luetkeana)* in the intertidal zone through the shallow subtidal zone in the northern half of the Brightwater Outfall Siting Area

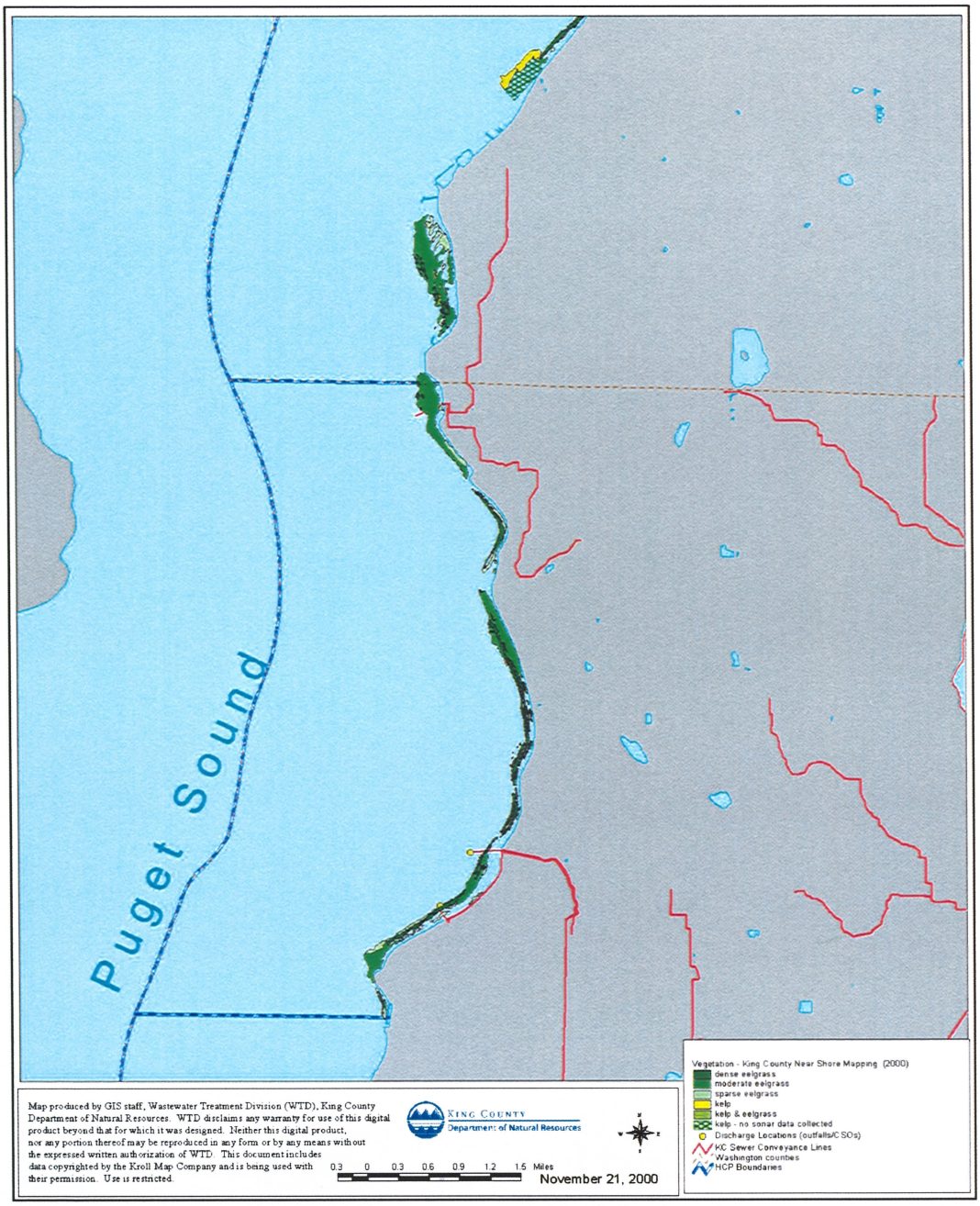

Figure 3-7. Distributions of eelgrass (*Zostera marina*) and kelp (*Nereocystis luetkeana)* in the intertidal zone through the shallow subtidal zone in the southern half of the Brightwater Outfall Siting Area

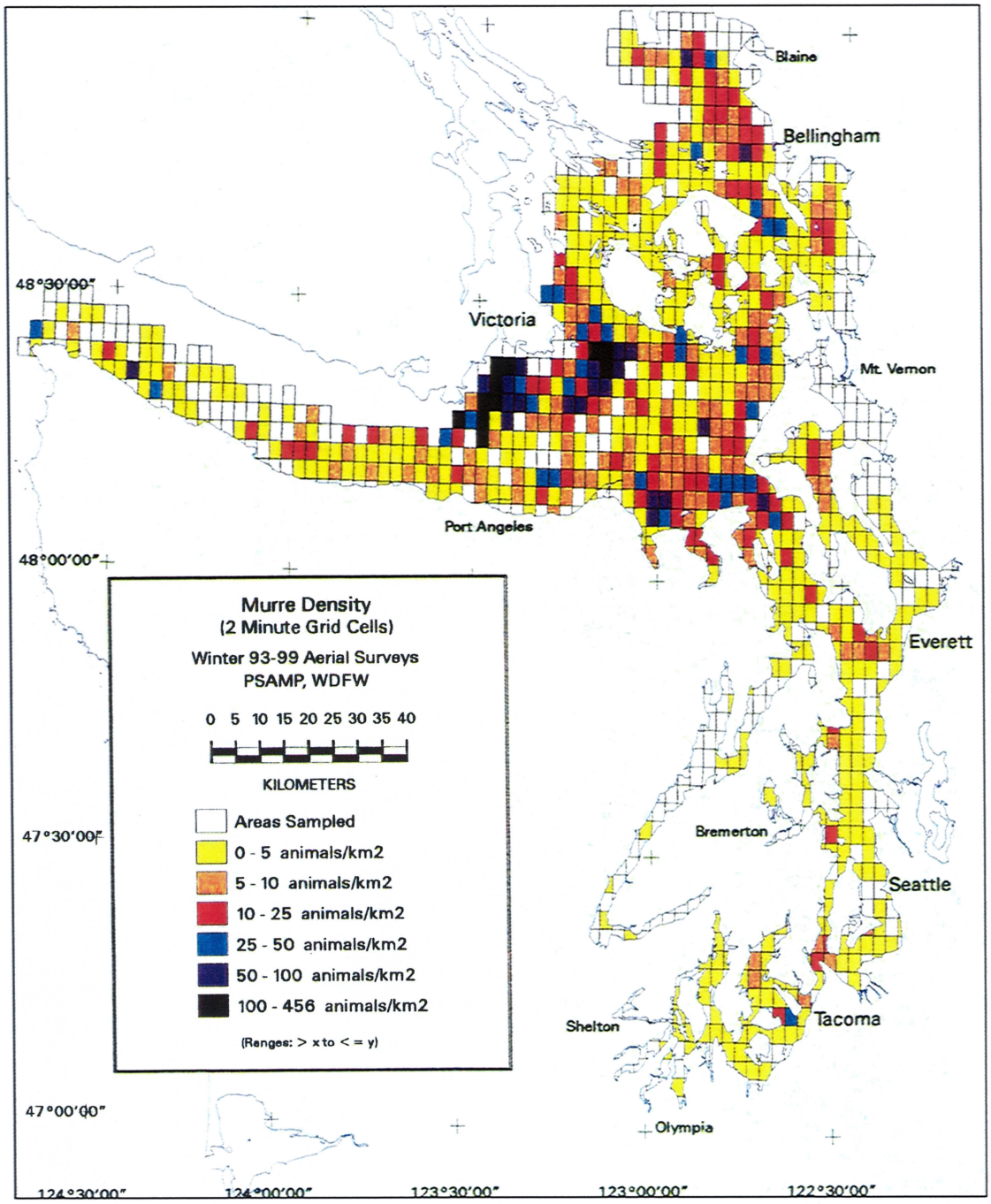

Figure 3-8. Density of common murres in winter

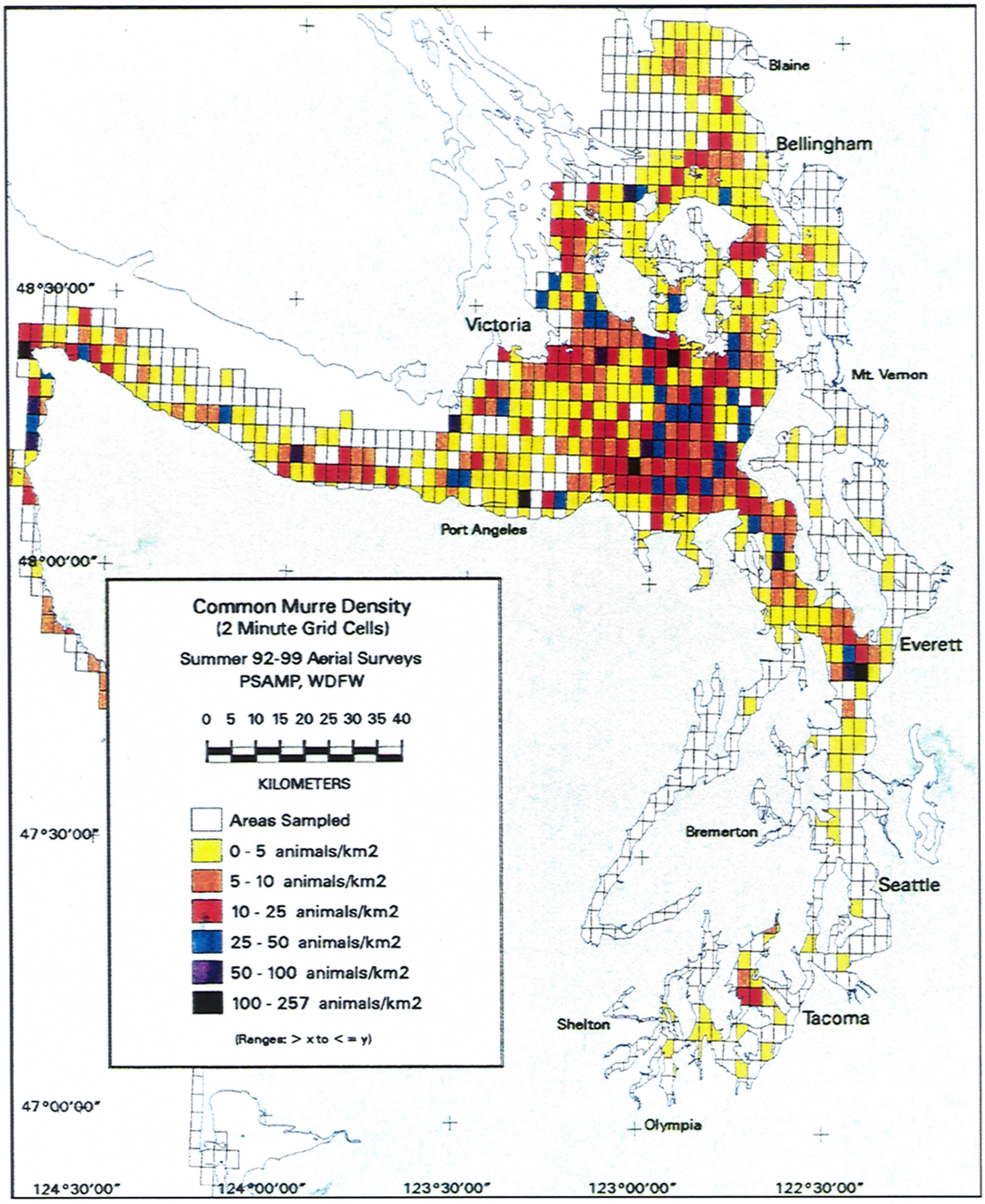

Figure 3-9. Density of common murres in summer

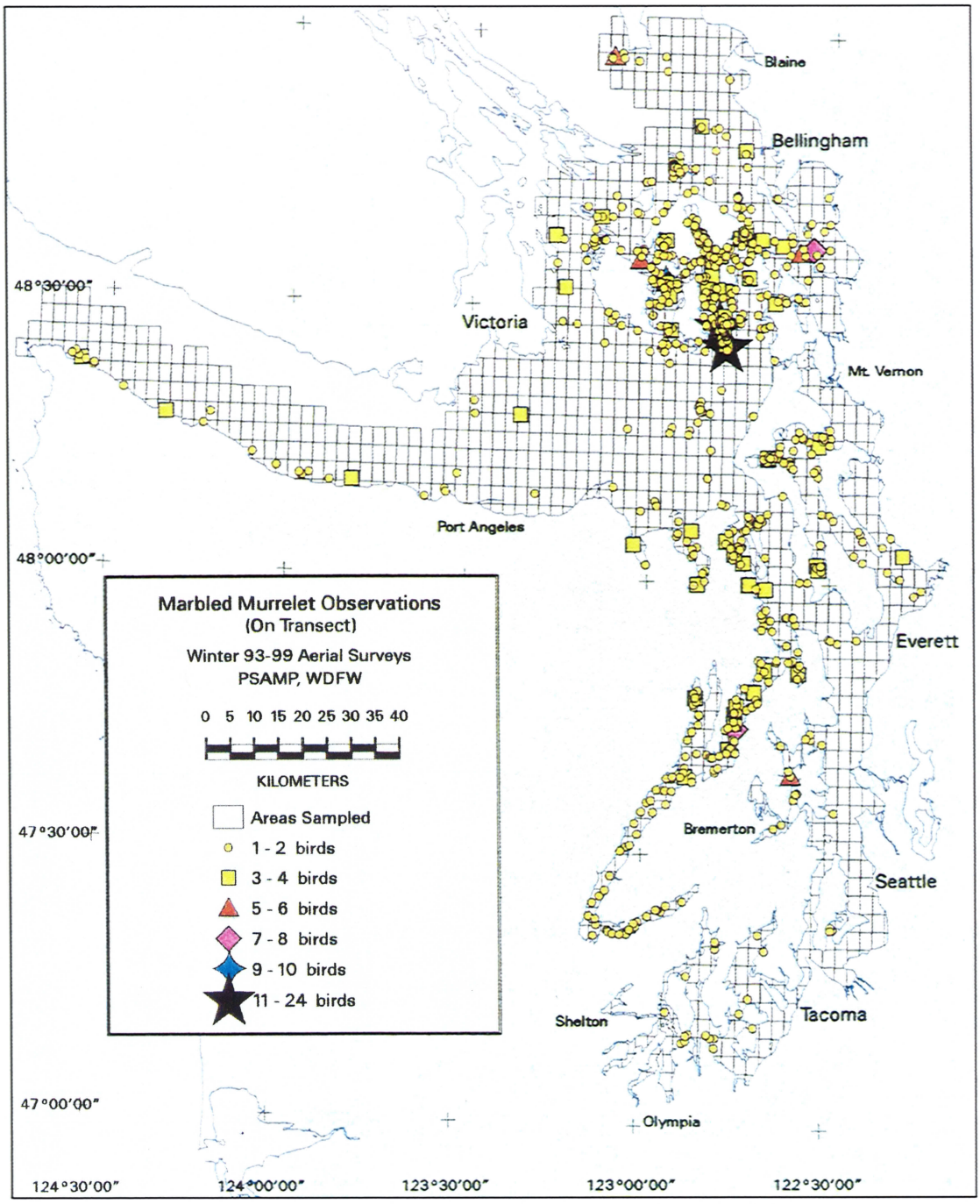

Figure 3-10. Density of marbled murrelets in winter

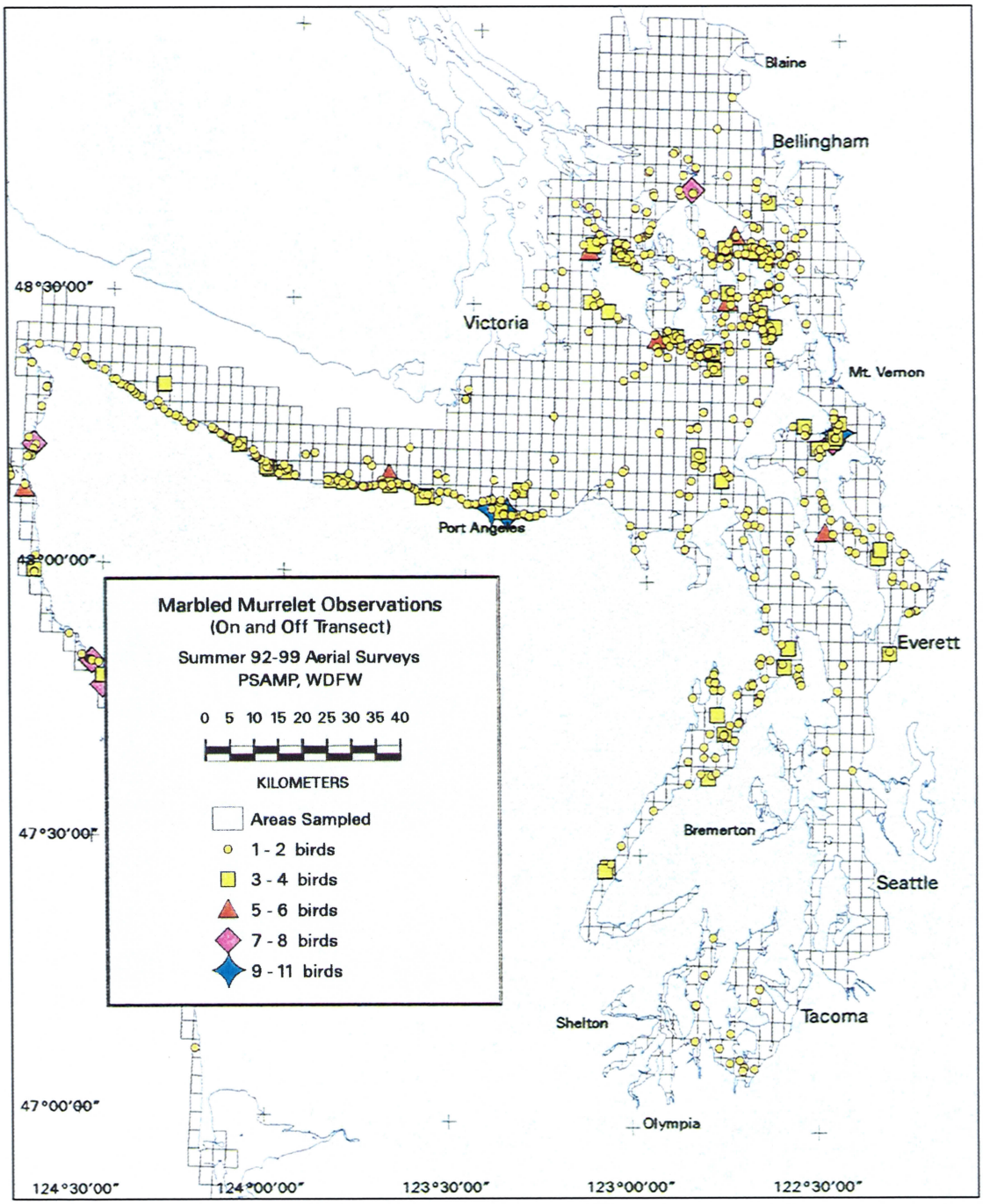

Figure 3-11. Density of marbled murrelets in summer

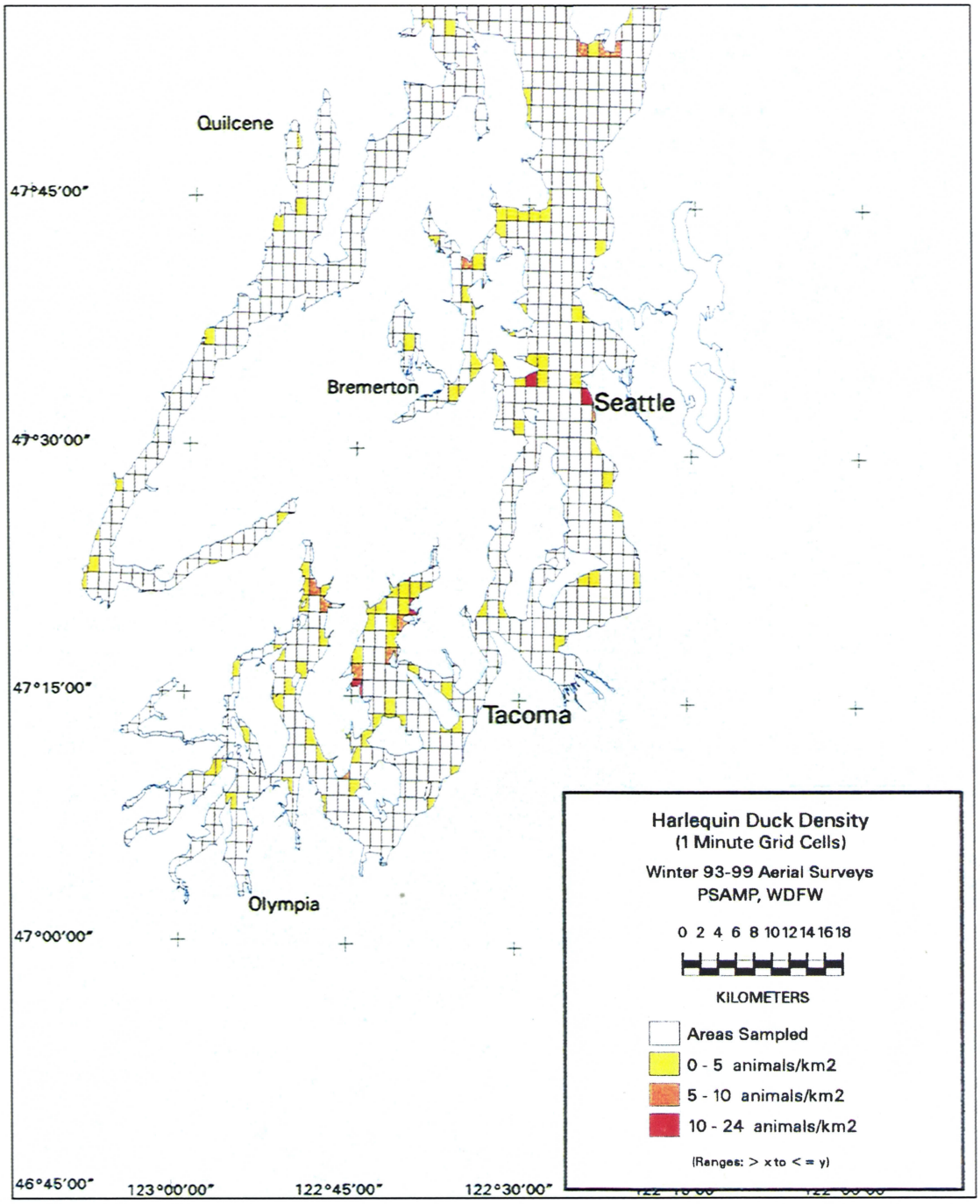

Figure 3-12. Density of harlequin ducks in winter

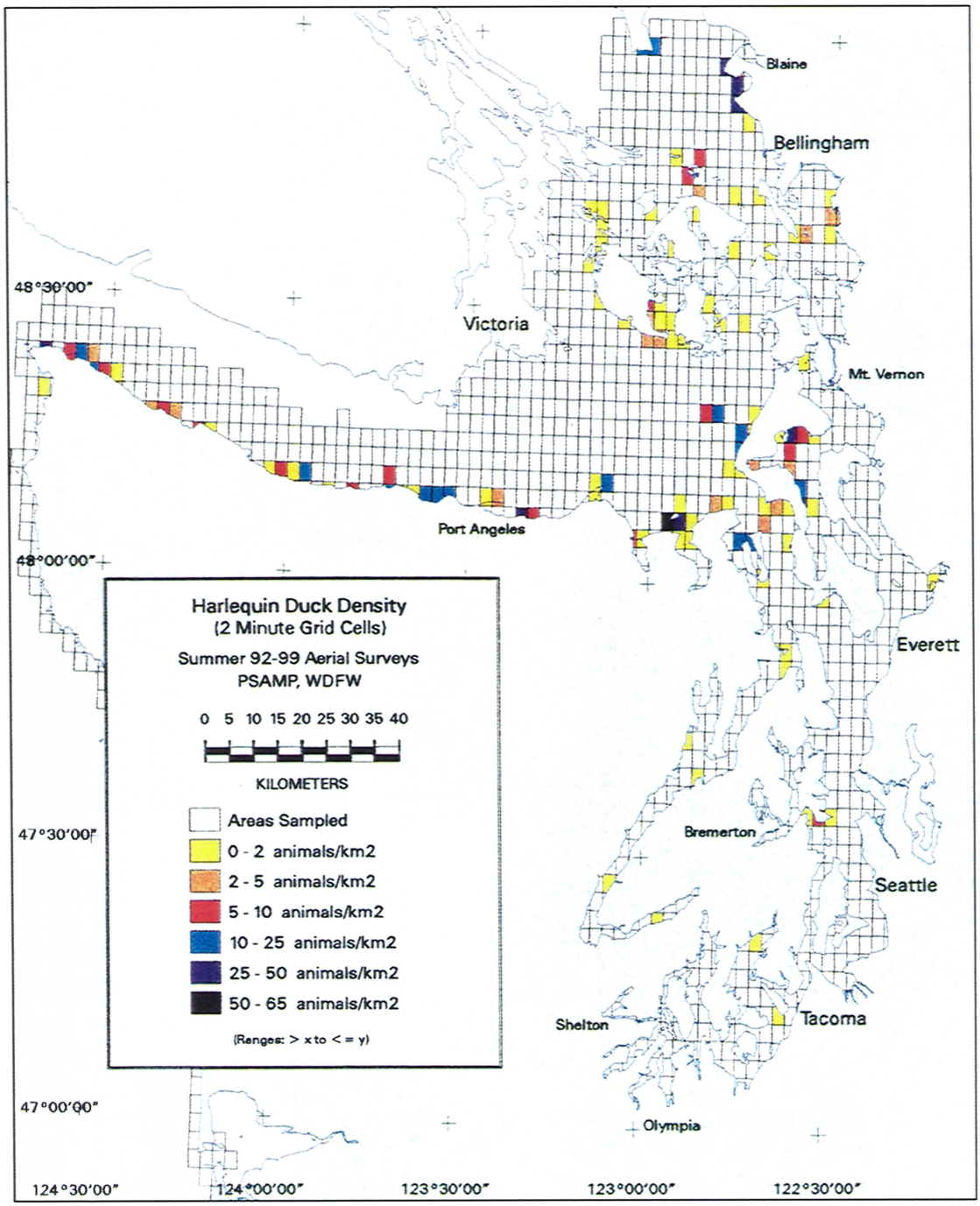

Figure 3-13. Density of harlequin ducks in summer

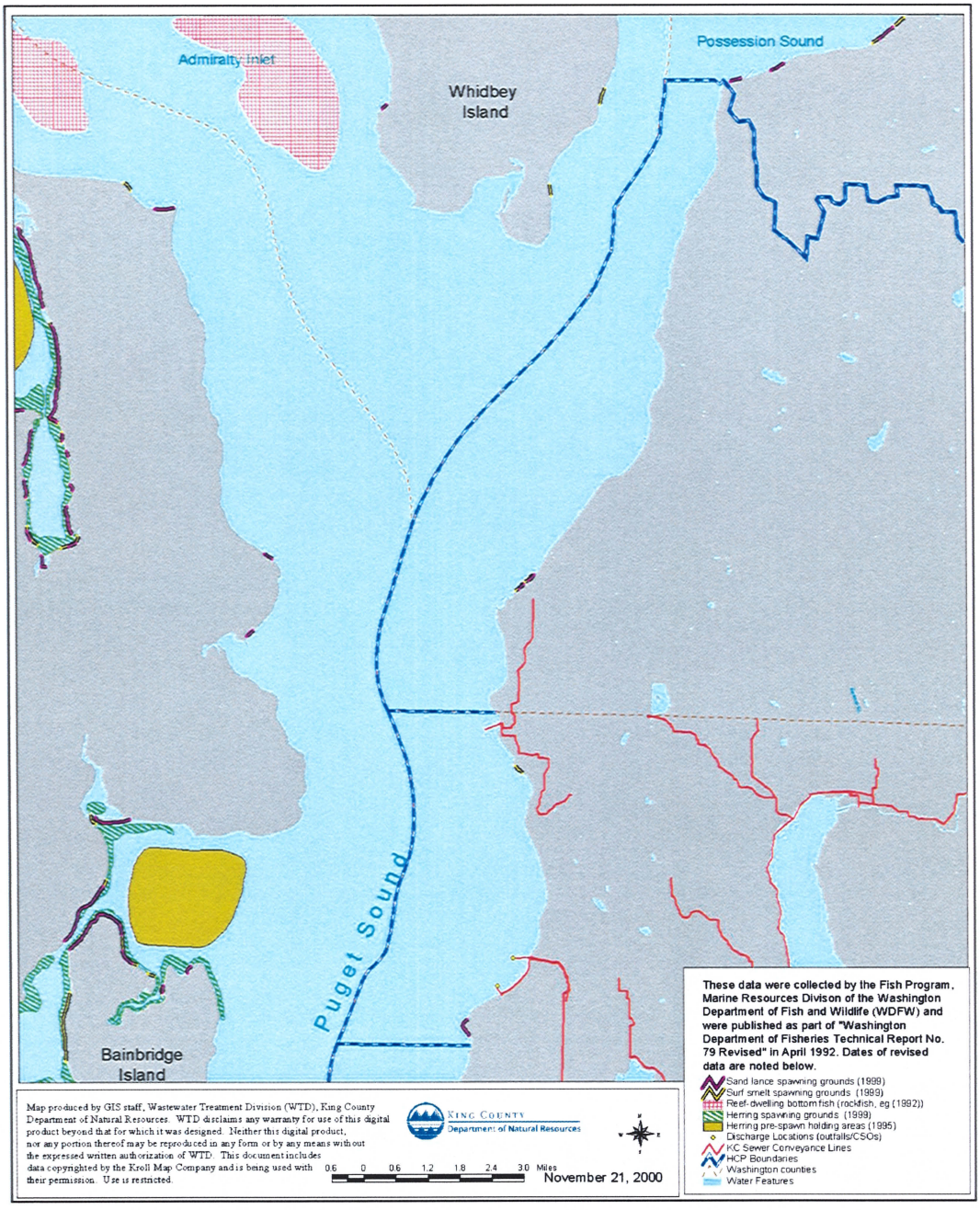

Figure 3-14. Forage fish spawning and holding areas and bottom fish/reef-dwelling habitats in the Brightwater Outfall Siting Area

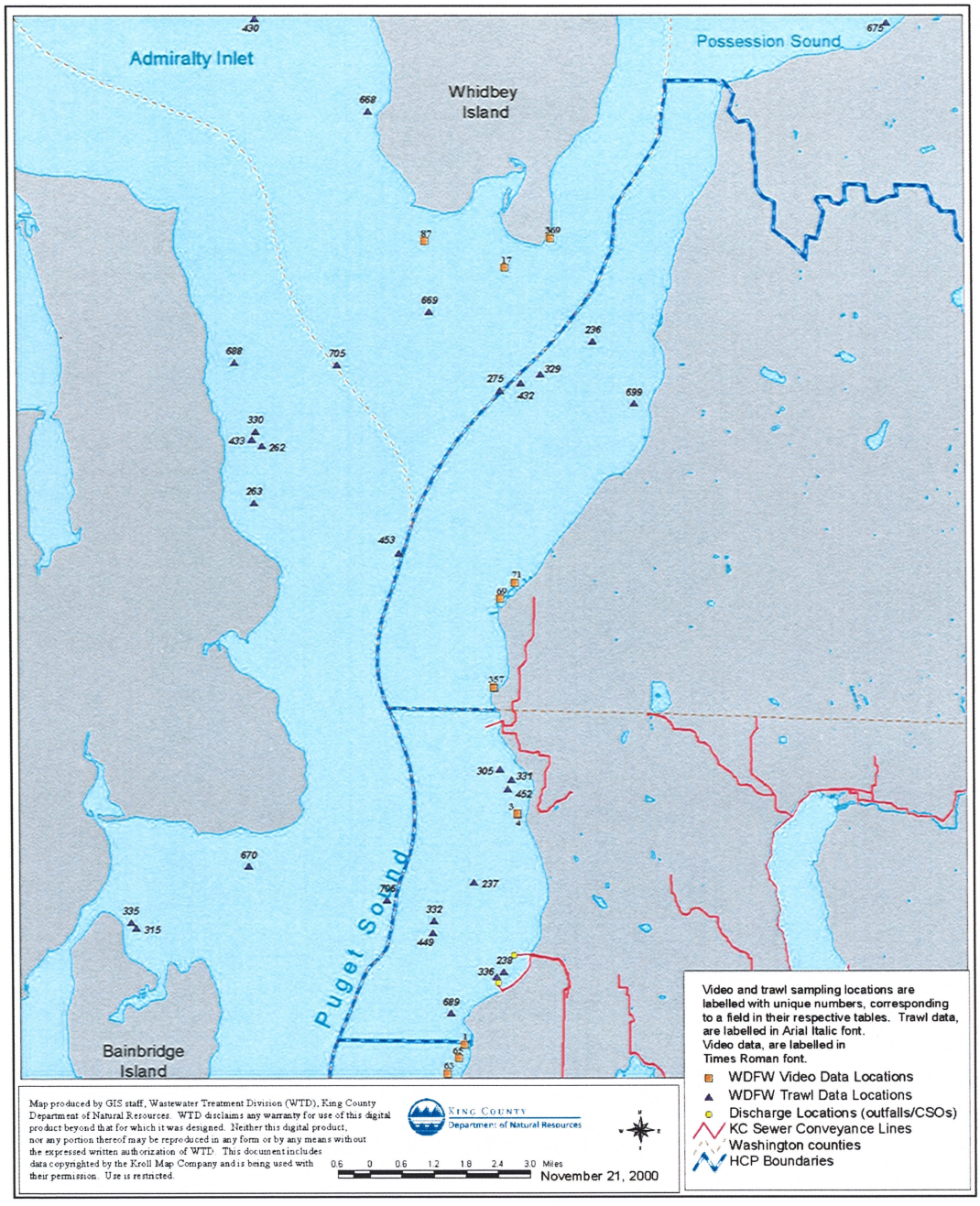

Figure 3-15. WDFW trawl and video marine fish data in the Brightwater Outfall Siting Area. See Appendix C for fish species noted at each location.

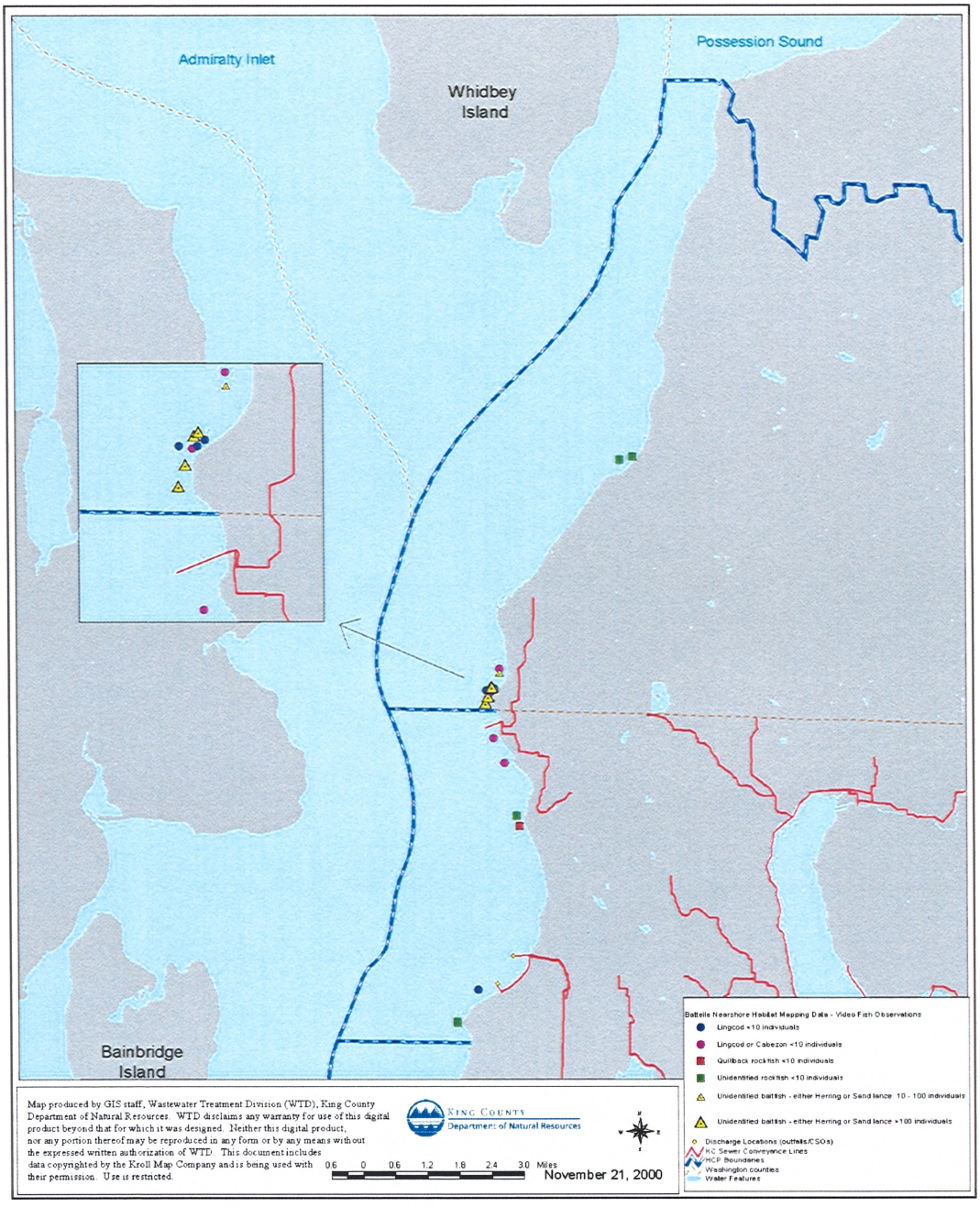

Figure 3-16. Battelle video marine fish data in the Brightwater Outfall Siting Area

Table 3-1. Marine fish species observed in the Brightwater Outfall Siting Area.[1]

Common Name	Genus species	Distribution	Primary habitat	Depth range (ft)	Average density (ind/m^2)	Relative abundance[2]
Green Sturgeon	*Acipenser medirostris*	none observed	NA	NA	NA	NA
White Sturgeon	*Acipenser transmontanus*	none observed	NA	NA	NA	NA
Pacific Cod (S & C P.S.)	*Gadus macrocephalus*	offshore from Edmonds, N & offshore from Meadow Pt, Meadow Pt	sand	30->360	0.0003[a]	5
Walleye Pollock (S. P.S.)	*Theragra chalcogramma*	N & offshore from Edmonds, S of Pt Wells, offshore between Pt Wells & Meadow Pt, Meadow Pt	NA	126->360	0.002[a]	9
Pacific Hake (C P.S.)	*Merluccius productus*	N & offshore from Edmonds, offshore from Edwards Pt, S of Pt Wells, N & offshore from Meadow Pt	NA	126->360	0.002[a]	12
Lingcod	*Ophiodon elongatus*	N side of Edwards Pt, N of Pt Wells, Pt Wells, S of Pt Wells, Meadow Pt	artificial structures	34-41	0.066[b]	7
Pacific Herring	*Clupea harengus pallasi*	N of Edmonds, offshore from Edwards Pt, S of Pt Wells, Meadow Pt	NA	126->360	0.0002[a]	4
Sand Lance	*Ammodytes hexapterus*	Spawning grounds (1 Nov to 15 Feb): N side Elliot Pt, N side Edwards Pt, Meadow Pt	sand gravel beaches for spawning	upper inter-tidal	NA	probably abundant during spawning
Unidentified Baitfish	*Herring or Sand Lance*	Pt Wells, between Pt Wells & Meadow Pt	NA	NA	NA	8
Surf Smelt	*Hypomesus pretiosus*	Spawning grounds (all year, mostly fall and winter in this area): N side of Edwards Pt, S of Pt Wells	very coarse sand to pea gravel beaches for spawning	upper inter-tidal		none observed during surveys, probably abundant during spawning
Eulachon	*Thaleichthys pacificus*	none observed	NA	NA	NA	NA

Table 3-1. Marine fish species observed in the Brightwater Outfall Siting Area.[1]

Common Name	Genus species	Distribution	Primary habitat	Depth range (ft)	Average density (ind/m^2)	Relative abundance[2]
Brown Rockfish	*Sebastes auriculatus*	none observed	NA	NA	NA	NA
Copper Rockfish	*Sebastes caurinus*	N side of Edwards Pt, Pt Wells, S of Pt Wells, Meadow Pt	artificial structures	21-41	0.079[b]	4
Greenstriped Rockfish	*Sebastes elongatus*	near Edmonds	mixed coarse	246-360	0.0001[a]	1
Widow Rockfish	*Sebastes entomelus*	none observed	NA	NA	NA	NA
Yellowtail Rockfish	*Sebastes flavidus*	none observed	NA	NA	NA	NA
Quillback Rockfish	*Sebastes maliger*	N & offshore from Edmonds, N & N side of Edwards Pt, Pt Wells, S of Pt Wells, Meadow Pt	boulders	17-66	0.609[b]	16
Black Rockfish	*Sebastes melanops*	none observed	NA	NA	NA	NA
Blue Rockfish	*Sebastes mystinus*	none observed	NA	NA	NA	NA
China Rockfish	*Sebastes nebulosus*	none observed	NA	NA	NA	NA
Tiger Rockfish	*Sebastes nigrocinctus*	none observed	NA	NA	NA	NA
Bocaccio	*Sebastes paucispinus*	none observed	NA	NA	NA	NA
Canary Rockfish	*Sebastes pinniger*	none observed	NA	NA	NA	NA
Redstripe Rockfish	*Sebastes proriger*	none observed	NA	NA	NA	NA
Yelloweye Rockfish	*Sebastes ruberrimus*	none observed	NA	NA	NA	NA
Unidentified Rockfish	*Sebastes spp.*	N & offshore from Edmonds, Edmonds, Edwards Pt, Pt Wells, S of Pt Wells, Meadow Pt	artificial structures	17-34	0.001[a]	8

NA - Not Available

[1]Based on data from Tech Report 79, Battelle, and WDFW.

[2]Relative abundance indicates the number of times a given species was observed during the surveys.

[a]Based on WDFW trawl surveys (Palsson data).

[b]Based on WDFW video surveys (Palsson data).